Universal Bimagic Squares and the day 10^{th} October 2010 (10.10.10)

Inder Jeet Taneja
Departamento de Matemática
Universidade Federal de Santa Catarina
88.040-900 Florianópolis, SC, Brazil.
e-mail: ijtaneja@gmail.com
http://www.mtm.ufsc.br/∼taneja

Abstract

In this short note we have produced for the first time in the history different kinds of universal bimagic squares. This we have made using only the digits 0,1 and 2. The universal bimagic squares of order 8×8 and 16×16 are with the digits 0 and 1. The universal bimagic square of order 9×9 is with the digits 0, 1 and 2. It is interesting to note that the day 0ctober 10 have only the digits 0 and 1 if we consider it as 10.10.10. If we consider the date as 10.10.2010, then this has the digits 0, 1 and 2.

1 Details

In this work we shall present *universal bimagic* squares of order 8×8 and 16×16 having only the digits 0 and 1. A *universal bimagic* square of order 9×9 is also presented having three digits 0, 1 and 2. These magic squares are based on the date October 10 (10.10.10 or 10.10.2010).

1.1 Universal and Bimagic Squares

Here below are some definitions.

- **Magic square**

A magic square is a collection of numbers put as a square matrix, where the sum of elements of each row, sum of elements of each column or sum of elements of each of two principal diagonals are the same. For simplicity, let us write this sum as **S1**.

- **Bimagic square**

Bimagic square is a magic square where the sum of square of each element of rows, columns or two principal diagonals are the same. For simplicity, let us write this sum as **S2**.

- **Universal magic square**

Universal magic square is a magic square with the following properties:

(i) **Upside down**, i.e., if we rotate it to 180 degrees, it remains magic square again;

(ii) **Mirror looking**, i.e., if we put it in front of mirror or see from the other side of the glass, or see on the other side of the paper, it always remains the magic square.

1.2 The date 10.10.10

It is interesting to note that at 10 hours, 10 minutes and 10 seconds of the day 10, month 10 and the year 10 have only the digits 1 and 0, i.e., 10-10-10-10-10-10. Let us divide it in two parts, i.e., 101010 – 101010. Thus we have two equal blocks of six algarisms. If we go only for the day, these digits repeats on others days too, such as

01-10-10; 01-01-10; 10-01-10, 11-10-10, etc.

If we go on hours, minutes and seconds we have many combinations of six algarisms only with the digits 0 and 1.

• 8×8 − Universal bimagic square of binary digits 0 and 1

We can make $2 \times 2 \times 2 \times 2 \times 2 \times 2$ or $2^6 = 64$ different numbers of six algarisms with the digits 0 and 1. Also, we can write $64 = 8 \times 8$. Here below is a **universal bimagic square** of order 8×8 having 64 different numbers using only the digits 0 and 1.

001111	101000	100011	000100	011010	111101	110110	010001
011001	111110	110101	010010	001100	101011	100000	000111
000000	100111	101100	001011	010101	110010	111001	011110
010110	110001	111010	011101	000011	100100	101111	001000
100101	000010	001001	101110	110000	010111	011100	111011
110011	010100	011111	111000	100110	000001	001010	101101
101010	001101	000110	100001	111111	011000	010011	110100
111100	011011	010000	110111	101001	001110	000101	100010

S1:=44444
S2:=44893328844

Also we have sum of each block of $2 \times 4 = 44444$ and the square of sum of each term in of each block of $2 \times 4 = 44893328844$

• 16×16 – Universal bimagic square of binary digits 0 and 1

Instead, considering six algarisms using only the digits 0 and 1, if we consider eight algarisms using we can make $2^8 = 256$ different numbers only with the digits 0 and 1. Also we we can write 256 as 16×16. Here below is a universal bimagic square of order 16×16 with these 256 different numbers made from the digits 0 and 1:

00001011	00010101	00101100	00110010	01001101	01010011	01101010	01110100	10000000	10011110	10100111	10111001	11000110	11011000	11100001	11111111
01101001	01110111	01001110	01010000	00101111	00110001	00001000	00010110	11100010	11111100	11000101	11011011	10100100	10111010	10000011	10011101
10111000	10100110	10011111	1000001	11111110	11100000	11011001	11000111	00110011	00101101	0010100	00001010	01110101	01101011	01010010	01001100
11011010	11000100	11111101	11100011	10011100	10000010	10111011	10100101	01010001	01001111	01110110	01101000	0010111	00001001	00110000	00101110
01010111	01001001	01110000	01101110	00010001	00001111	00110110	00101000	11011100	11000010	11111011	11100101	10011010	10000100	10111101	10100011
00110101	00101011	00010010	00001100	01110011	01101101	01010100	01001010	10111110	10100000	10011001	10000111	11111000	11100110	11011111	11000001
11100100	11111010	11000011	11011101	10100010	10111100	10000101	10011011	01101111	01110001	01001000	01010110	00101001	00110111	00001110	00010000
10000110	10011000	10100001	10111111	11000000	11011110	11100111	11111001	00001101	00010011	00101010	00110100	01001011	01010101	01101100	01110010
10101111	10110001	10001000	10010110	11101001	11110111	11001110	11010000	00100100	00111010	00000011	00011101	01100010	01111100	01000101	01011011
11001101	11010011	11101010	11110100	10001011	10010101	10101100	10110010	01000110	01011000	01100001	01111111	00000000	00011110	00100111	00111001
00011100	00000010	00111011	00100101	01011010	01000100	01111101	01100011	10010111	10001001	10110000	10101110	11010001	11001111	11110110	11101000
01111110	01100000	01011001	01000111	00111000	00100110	00011111	00000001	11110101	11101011	11010010	11001100	10110011	10101101	10010100	10001010
11110011	11101101	11010100	11001010	10110101	10101011	10010010	10001100	01111000	01100110	01011111	01000001	00111110	00100000	00011001	00000111
10010001	10001111	10110110	10101000	11010111	11001001	11110000	11101110	00011010	00000100	00111101	00100011	01011100	01000010	01111011	01100101
01000000	01011110	01100111	01111001	00000110	00011000	00100001	00111111	11001011	11010101	11101100	11110010	10001101	10010011	10101010	10110100
00100010	00111100	00000101	00011011	01100100	01111010	01000011	01011101	10101001	10110111	10001110	10010000	11101111	11110001	11001000	11010110

S1:=88888888
S2:=897867554657688

Also we have sum of each block of $4 \times 4 = 88888888$ and square of sum of each term in of each block of $4 \times 4 = 897867554657688$.

1.3 The date 10.10.2010

Instead, considering the year as 10, if we consider it as 2010, then we have three algarisms 0, 1 and 2. These digits happens on other days too, such as

02.01.2010; 02.02.2010; 20.10.2010; 02.10.2010; 12.10.2010; 2.10.2010, etc.

Still there are many other dates having only the digits 0, 1 and 2.

• 9×9 – Universal bimagic square of digits 0, 1 and 2

We can make exactly 81 different numbers having four algarisms from the three digits 0, 1 and 2, i.e, $3 \times 3 \times 3 \times 3 = 81$. Also we can write, $81 = 9 \times 9$. Here below is a universal bimagic square of order 9×9 having only the digits 0, 1 and 2 with 81 different numbers.

0000	0122	0211	1021	1110	1202	2012	2101	2220
1012	1101	1220	2000	2122	2211	0021	0110	0202
2021	2110	2202	0012	0101	0220	1000	1122	1211
0222	0011	0100	1210	1002	1121	2201	2020	2112
1201	1020	1112	2222	2011	2100	0210	0002	0121
2210	2002	2121	0201	0020	0112	1222	1011	1100
0111	0200	0022	1102	1221	1010	2120	2212	2001
1120	1212	1001	2111	2200	2022	0102	0221	0010
2102	2221	2010	0120	0212	0001	1111	1200	1022

S1:=9999
S2:=17169395

Also we have sum of each block of $3 \times 3 = 9999$ and square of sum of each term in of each block of $3 \times 3 = 17169495$

We observe that from the above magic square that if we make a rotation of 180 degrees the digits 2 remains the 2 but if we see it in the mirror 2 becomes 5. Obviously, in this case the sum S1 and S2 are not the same as given above. But still it is a magic square. If we want to have the same sum, we have to use 2 and 5 together (in the digital form) with either 0, 1 or 8. This study is given in the anther work Taneja [5].

For more studies on magic and bimagic squares, we suggest to the readers the two sites [1], [2] where one can find a good collection of work, papers, books, etc. The idea of universal bimagic square is presented for the first time here.

References

[1] *http://www.multimagie.com/indexengl.htm.*

[2] *http://recmath.org/Magic Squares.*

[3] I.J. TANEJA – DIGITAL ERA: Magic Squares and 8^{th} May 2010 (08.05.2010), *http://arxiv.org/ftp/arxiv/papers/1005/1005.1384.pdf.*

[4] I.J. TANEJA – ERA DIGITAL E 50 ANOS DA UFSC, *http://www.50anos.ufsc.br/Homenagem MTM.pdf.*

[5] I.J. TANEJA – DIGITAL ERA: Universal bimagic squares – Under preparation.